Appendix G

North Bend Gravel Operation
Energy Technical Report

NORTH BEND GRAVEL OPERATION
ENERGY TECHNICAL REPORT

For

KING COUNTY
URS JOB NO.: 53-42279001.00
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1.0 INTRODUCTION

This technical report addresses the energy usage and change in use patterns associated with the proposed development of gravel extraction and processing operations in North Bend, Washington. Direct energy uses include vehicle and truck traffic; mining and processing equipment; conveyor systems; water/wastewater handling systems; and the heating, cooling, and illumination of buildings. Indirect energy use may include construction or maintenance activities associated with transportation or operations in the study area. This technical report identifies direct and indirect energy uses in the study area and qualitatively assesses the impacts of four project alternatives.

1.1 ALTERNATIVES

Development of a gravel extraction and processing operation has been proposed on land east of North Bend, in unincorporated King County. Four alternatives have been defined for the land, which are the basis for the energy analyses presented in this technical report:

- Alternative 1–No Action.
- Alternative 2–Proposal: Lower and Upper Sites Mining - Exit 34. Involves development of two separate areas of land, referred to as the Lower Site and the Upper Site, for gravel extraction and processing. Operations would include the excavation, washing, crushing, sorting, and stockpiling of sand and gravel. Construction of concrete and asphalt batch plants at the Lower Site is planned in later stages of site development. Extraction would initially occur in the Lower Site, with material hauled from the site via Exit 34. Material from the Upper Site would be moved to the Lower Site using a 36- to 42-inch-wide conveyor.
- ALTERNATIVE 2A–Upper Site Mining and Limited Lower Site Mining. Cadman, Inc. has included this option to decrease the footprint of the Lower Site's gravel operations to keep the operations at least one-quarter mile from the nearest residence. The amount of gravel to be removed will be reduced accordingly.
- Alternative 3–Lower and Upper Sites Mining - Exits 34 and Exit 38. Gravel extracted from the Lower Site would be transported from the site via Exit 34. After extraction has been completed at the Lower Site, the Upper Site would be developed, with material hauled out via Exit 38 and SE Grouse Ridge Road. Aggregate processing would take place on the Upper Site. The concrete and asphalt batch plants would be located at the Lower Site. This alternative does not include a conveyor line between the Lower and Upper Sites.
- Alternative 3A–Upper Site Mining and Limited Lower Site Mining - Exits 34 and 38. Cadman, Inc. has included this option to decrease the footprint of the Lower Site's gravel operations to keep the operations at least one-quarter mile from the nearest residence. The amount of gravel to be removed will be reduced accordingly.
- Alternative 4–Upper Site Mining - Exit 38. Under this alternative, the Lower Site would not be developed. Extraction and aggregate processing would occur at the Upper Site, with processed materials hauled out via SE Grouse Ridge Road. Onsite concrete and asphalt batch plants are not included in this alternative.

1.2 STUDY AREA

The gravel mining operation is proposed to take place on land located east of North Bend, Washington, in unincorporated King County. The land is owned by Weyerhaeuser Company and leased to Cadman, Inc. Two separate sites would be leased for the proposed development. The Lower Site is north of I-90 and east of 468th Avenue SE. The Lower Site is about 115 acres. The Upper Site is north of I-90 on the Grouse Ridge plateau, and is about 578 acres. The sites are approximately 1 mile apart. The Upper Site is approximately 900 feet higher than the Lower Site.

The energy analysis study area includes the two leased sites (approximately 693 acres), the conveyor line connecting the sites, and the energy used to transport aggregate to either onsite or offsite processing facilities. Figure 1-1 shows the geographic bounds of the area considered in the energy analysis. The energy uses and analyses presented within this technical report are limited to that study area.

1.3 METHODOLOGY

The methodology used to assess energy uses and impacts is derived from the Washington State Environmental Policy Act Rules, WAC Chapter 197-22. The energy uses, sources, and environmental consequences associated with the proposed alternatives have been evaluated. Local energy providers have been contacted to verify their service capabilities and capacities.

1.4 AGENCY COORDINATION AND INVOLVEMENT

The Washington State Department of Transportation (WSDOT) was contacted for assistance in estimating the number of vehicles traveling along the I-90 corridor. WSDOT no longer has an assigned energy representative in its environmental division.

2.0 AFFECTED ENVIRONMENT

2.1 REGIONAL ENERGY USAGE

Hydroelectric dams provide more than 80% of the energy generating capability in Washington. Most of these are federally owned, including the largest electric power plant in the United States–Grand Coulee Dam. As a result, Washington enjoys some of the lowest priced electricity in the nation. The power produced by these dams is marketed through the Bonneville Power Administration (BPA). BPA supplies many of the state's 43 publicly owned utilities and 17 cooperatives with electricity generated by hydropower and nuclear power plants. These utilities control more than half of the retail sales of electricity in the state. Investor-owned utilities, of which Puget Sound Energy (PSE) is the largest in the state, make up about 33% of retail sales. The remainder is sold by BPA directly to large industrial customers.

2.2 LOCAL ENERGY USAGE

2.2.1 Electrical

Electrical power in the North Bend area is provided by two utility distributors: PSE and Tanner Electric Company. PSE provides electricity, natural gas, and energy-related services to more than 1 million customers in 11 counties within Washington State. PSE supplies approximately 95% of the power used in the North Bend area. Tanner Electric Company is a smaller utility distributor, headquartered in North Bend, that supplies electricity to portions of King and Pierce Counties. Aboveground and underground power distribution lines service residences and businesses in the area. An existing underground power distribution line, owned by PSE, enters the Upper Site from a point near the Washington State Patrol Fire Training Academy and runs along SE Grouse Ridge Road. A BPA utility transmission line runs through the southern border of the Upper Site.

2.2.2 Fuel

WSDOT has not developed a standard model for evaluating energy usage by vehicles, but other states have developed tools for evaluating energy use. Table 2-1 is a spreadsheet used by the Oregon Department of Transportation (ODOT) to estimate energy consumption by vehicles. The input values used for the spreadsheet are based on the following:

- WSDOT's Travel Data Processing Office has traffic counts from 1994 and 1997 for the I-90/Edgewick Road (Exit 34) Interchange. Based on 1997 data, approximately 29,252 vehicles per day currently travel along I-90. WSDOT records indicate about 14,634 vehicles per day travel eastbound on I-90; and an average of 14,566 vehicles per day travel westbound. Approximately 20% of these vehicles are heavy trucks.
- Energy consumption has been benchmarked using a travel distance of 1 mile, providing a unit basis for comparison to traffic associated with the development alternatives.
- The annual fuel energy consumed by passenger vehicles and trucks was obtained from a June 1988 reference guide published by the State of California Department of Transportation (CALTRANS) that used a Motor Fuel Consumption Model to estimate fuel consumption rates

at various highway speeds. The fuel consumption data for a highway speed of 55 miles per hour (mph) and a residential-type roadway speed of 20 mph was used for this evaluation.

ODOT's spreadsheet was used to calculate fuel consumption rates (FCRs) for heavy trucks and automobiles. Table 2-1 shows that fuel usage equivalent to 199,100,000 British Thermal Units (BTUs) per day is consumed in each 1-mile section of I-90 from approximately 30,000 cars and trucks (approximately 1,430 gallons of diesel fuel per day per mile). Heavy trucks, which are estimated to represent 20% of traffic, consume 99.8 million BTUs per day per mile (720 gallons of diesel fuel per day per mile), or about 50% of the energy used per mile. Annually, passenger vehicles and trucks consume 72.7 billion BTUs per mile, which is equivalent to approximately 520,000 gallons of diesel fuel per mile based on the approximate equivalent heat of combustion of diesel fuel in vehicles traveling 55 mph. The transportation-related energy impact of each development alternative will be compared to these benchmarks.

2.2.3 Natural Gas

Most households in North Bend have natural gas service. The distribution systems are owned and operated by PSE. An existing 4-inch gas main is located along 468th Avenue SE and terminates at Seattle Truck Town East, near Exit 34. The gas line does not enter into the boundaries of the Upper or Lower Site.

2.2.4 Buildings

There are currently no buildings within the defined study area. A number of private residences and small businesses lie outside the site boundary. There are approximately 52 residences within a half-mile of the proposed gravel operation. These residences are primarily single-family dwellings; one multiple-tenant residence, the Lu residence, is located nearby.

2.3 ENERGY SUPPLY

2.3.1 Electrical

PSE or Tanner Electric Company could supply electrical energy for the proposed development. PSE operates the only existing substation in North Bend. This 25-megawatt (MW) substation is at the intersection of Thrasher and 120th in North Bend. The substation has 4 circuits and a single power transformer that reduce the incoming 115 kilovolt (kV) power to 12.5 kV. A step-up transformer at Seattle Truck Town East increases the power to 34.5 kV. The average household in North Bend uses approximately 40-kilowatt hours (kW h) of electricity per day (1,150 kW h per month). This equates to an electrical demand of 3 kW per each household. PSE complies with minimum industry standards for controlling voltage fluctuations in primary power supplies. PSE has established their own guidance (document 0600.4100 *Voltage Flicker on Secondary Systems*) for designing services for new customer. PSE has indicated that evaluations are also done during the design phase to verify that the voltage dip is less than 2.0%. PSE personnel did note that customers are generally responsible for installing power-quality equipment such as surge arrestors, current-limiting reactors, circuit breakers, or disconnects for their onsite equipment.

Tanner Electric distributes power from PSE's substation through an 8 MW circuit. Tanner Electric has constructed a new 25 MW substation on Alm Way, west of PSE's existing substation. The substation has

the capacity to expand to provide 50 MW. Tanner Electric plans to expand the facility when necessary. The new substation will supply power to a new school near Exit 34 (Middle School No. 3) and a proposed commercial office park west of Seattle Truck Town East. The new 25 MW facility is expected to be operational in December 2001. When it comes online, the substation will have a maximum usage of 8.2 MW, about one-third of the capacity of the substation. PSE has indicated that the new Tanner Electric substation will relieve pressure from PSE's substation, which is currently being used at near full capacity.

2.3.2 Fuel

The study area does not contain any existing fuel storage or dispensing facilities. There are three gas stations located near Exit 34: Seattle Truck Town East, a 76 station, and a Texaco station. Seattle Truck Town East and the 76 station are both operated by Truck Town Incorporated. Truck Town, Inc., also leases a portion of its property (including its storage tanks) to Pacific Pride, a bulk fuel distributor. Seattle Truck Town East has eight fueling islands for diesel and two islands for diesel and gasoline. The 76 station sells gasoline. Truck Town Incorporated's total fuel storage capacity is 123,000 gallons. The Texaco station sells gasoline and diesel fuel; the station's total storage capacity was not verified.

2.3.3 Gas

The study area does not have any existing natural gas supply lines or services. An existing 4-inch PSE natural gas main is located along 468th Avenue SE and terminates at Seattle Truck Town East, near Exit 34. The gas line does not enter the boundaries of the Upper or Lower Site. Several reinforcement lines are planned by PSE over the next 2 to 3 years to keep pace with normal residential/commercial customer growth. When the reinforcements are complete, approximately 5,000 cubic feet per hour (cfh) is the maximum peak-hour load at low-pressure delivery that could be served at the end of the system.

3.0 ENVIRONMENTAL IMPACTS

3.1 INDIRECT (CONSTRUCTION) ENERGY IMPACTS

Indirect energy impacts are evaluated in the following section for the four project alternatives defined in Section 1. Indirect energy impacts include energy-use activities that occur as a result of direct energy use activities (i.e., maintenance of equipment and roadway construction).

3.1.1 Alternative 1–No Action

There are no indirect energy impacts associated with the No Action Alternative.

3.1.2 Alternatives 2, 2A, 3 and 3A

The following is a list of indirect energy-use impacts for Alternatives 2, 2A, 3 and 3A:

- Construction and enhancement of roadways
- Construction of buildings and a conveyor system (Alternative 2 only)
- Construction of processing facilities, a water piping system, and settling ponds
- Clearing of trees and vegetation
- Maintenance of vehicles, equipment, and the conveyor
- Reclamation activities
- Continuation of existing electrical service to reach the site
- Developing power quality control measures

Energy consumption for these activities would be short-term and have a low impact compared to direct energy impacts. Most of the construction-related activities would occur during the preliminary stages of the project, whereas maintenance activities would be ongoing. Reclamation activities would involve removal of equipment, buildings, asphalt, and support structures and materials. There would also be an indirect impact for grading, fertilizing, and planting the evacuated land.

Overall energy use for these indirect impacts is assumed to be similar for Alternatives 2, 2A, 3 and 3A.

3.1.3 Alternative 4–Upper Site Mining - Exit 38

Indirect impacts associated with Alternative 4 would be similar to, but less than impacts on Alternatives 2 and 3 because of a smaller area of impact. The same impacts would apply to this alternative as previously described for Alternatives 2 and 3, with the exception of the construction and maintenance of the conveyor line (not part of this alternative). The overall indirect energy use is approximately 5% lower for this alternative as compared to Alternatives 2 and 3.

3.2 DIRECT (OPERATION) ENERGY IMPACTS

The direct energy impacts of the four project alternatives defined in Section 1 are evaluated in the following section. Direct energy impacts include any energy use activities associated with operation of the Lower and Upper Sites (such as excavation, processing equipment, and vehicle operations).

3.2.1 Alternative 1–No Action

There are no direct energy impacts associated with the No Action Alternative.

3.2.2 Alternative 2–Proposal: Lower and Upper Sites Mining - Exit 34

A number of energy use activities that are part of the Proposal are considered direct impacts on energy use in the study area, such as additional truck traffic on I-90, mining excavation equipment, aggregate processing equipment, asphalt and batch plant equipment, the conveyor line connecting the Lower and Upper Sites, process water handling equipment, and building energy use.

Electrical

The electrical load at the proposed gravel operation is approximately 3.6 megawatts (MW, 3600 kW). This load represents approximately 1,200 average houses (3 kW per house) in North Bend. The majority of the electrical load would be at the Lower Site, where processing of the material would occur. A processing facility, including an asphalt batch plant, secondary and tertiary crushers, vertical sorting screens, washing equipment, dust-control devices, and conveyors, would be constructed during Phase 3 of the Proposal. Electrical load on the Upper Site would be limited to area lighting. An existing underground power line at the Upper Site would need to be removed or relocated when excavation begins in that area. Relocation issues are discussed in the Public Utilities Technical Report.

The 36- or 42-inch-wide conveyor line that transfers material down to the Lower Site would incur operational electrical load from Phase 4 through Phase 9 of the Proposal. The proposed conveyor system could be designed to generate electricity, offsetting the electrical load of the conveyor itself. A similar system is currently in use at the Lone Star NW gravel facility, which generates approximately 450 horsepower when in operation. The conveyor requires power upon startup, but then produces electricity as it operates. Other electrical loads would include the pumps to move water from the wells to an onsite passive freshwater storage pond, pumps for potable water from the wells, and pumps to transfer the water from the Lower to the Upper Site.

Once the Tanner substation is operational, either the new Tanner substation or PSE's existing substation will be capable of supplying the site's 3.6 MW demand. PSE indicated that a separate circuit could be used to supply Cadman, Inc. with electricity to power its equipment and facilities. A new distribution line would likely be constructed at the west entrance of the Lower Site and tie into existing lines along SE 146th Street; existing power lines may be upgraded at that time. Both Tanner Electric and PSE are governed by the Washington Administrative Code, which addresses power-quality issues such as flickering or dimming of power supplies to residences and business on the same power grid. PSE control standards require that none of its customers cause greater than a 2% voltage dip to any neighboring customers' service. Mitigation to ensure these standards are met can be achieved through cooperation between Cadman, Inc. and the local

power supplier that it chooses. There would be a low potential for impacts on local electrical energy usage with this alternative if mitigation is implemented.

Fuel

Fuel for Onsite Uses

Heavy equipment at the Lower Site would include several rubber-wheeled front-end loaders, gravel-dump trucks and ready-mix concrete trucks. Heavy equipment use at the Upper Site would include one rubber-wheeled front-end loader and one bulldozer.

A fuel storage facility, with secondary containment in case of a spill, would be constructed during Phase 3 of the Proposal. Cadman, Inc. is initially planning to install only one aboveground 14,000-gallon fuel tank. This tank would provide onsite diesel storage and dispensing equipment to fuel gravel trucks, front-end loaders, gravel-dump trucks, bulldozer and ready-mix concrete trucks. Fuel deliveries would occur on an as-needed basis to fill the double-walled storage tank. No offsite fueling of equipment or transportation vehicles is planned.

In Phase 7, process water would also be pumped into settling ponds at the Upper Site. These ponds would settle and separate soil, silts, and clays from gravel processing and truck washing activities. The water would then be recycled through the processing plant. Temporary settling ponds would be installed at the Lower Site for this purpose during Phases 5 and 6.

Natural gas is the normal fuel for an asphalt batch plant's asphalt rotary dryer. However, PSE's current gas distribution system cannot serve Cadman's estimated demand of 120,000 cubic feet per hour (cfh). When this load is modeled on the current system, the entire North Bend system would experience outages (approximately 1,740 customers). This is not an option for PSE. The North Bend distribution system is fed by a line supply and regulator several miles from the proposed site. In order to feed the site through a supply line from this source, approximately 50,000 feet of steel supply line operating at 250 pounds per square inch (psi) would need to be installed. This installation would cost approximately $5.5 million, but routing, river crossings, and municipal requirements could substantially increase the cost (Puget Sound Energy, 1999).

As an alternative to natural gas for the asphalt batch plant, Cadman, Inc. has proposed using propane gas. A 10,000-gallon propane tank would be installed on site. The asphalt batch process would use 2 gallons of propane to fuel its asphalt rotary dryer for every 1 ton of asphalt produced (Cadman, Inc., 1999, and telephone conversation with Rod Shearer of Cadman, Inc. 7/19/99). It is estimated that 150,000 tons of asphalt would be produced onsite each year, requiring 300,000 gallons of propane gas annually, and an energy consumption of 27.4 billion BTUs. Cadman, Inc. would comply with all applicable regulations regarding storage and use of propane gas.

Another possible source of fuel for asphalt processing is diesel fuel. Cadman, Inc. has already proposed an aboveground, 14,000-gallon fuel tank to be stored onsite for fueling vehicles. The asphalt batch plant uses approximately 2.0 to 2.5 gallons of diesel per ton of asphalt produced (Cadman, Inc., 1999). If 150,000 tons of asphalt are produced per year, this would require 375,000 gallons of diesel fuel, or an energy

consumption of 52 billion BTUs. Another 15,000- to 20,000-gallon onsite fuel tank is necessary if diesel fuel is used for this process.

Fuel storage requirements for this alternative (30,000 to 35,000 gallons) are comparable to a commercial service station such as Truck Town, Inc.'s 76 station (38,000 gallons of storage). Yearly fuel use would be similar to the sales of a small service station, of which there are hundreds within King County. This would result in a low impact on the diesel fuel supply within the region

Fuel for Transport

During Phase 2 of the Proposal, gravel extracted from the Lower Site would be hauled offsite for processing. The average haul distance for offsite processing is 23 miles. Approximately 60% of the material would be transported to Cadman, Inc.'s Issaquah facility, located 18 miles from North Bend. Up to 40% of the material would be transported to Cadman, Inc.'s Redmond facility, located 30 miles from North Bend.

Traffic associated with Alternative 2 is summarized in Table 3-1. Heffron Transportation has analyzed traffic data for this stretch of I-90 (Heffron, 1999). Based on these estimates, one-way traffic along I-90 would increase by 936 heavy trucks and 62 passenger vehicle trips per day. Alternative 2's traffic represents an energy consumption of 32.5 million BTUs per day per mile of highway (235 gallons of diesel fuel per day per mile), or 11.9 billion BTUs per year per mile of highway (86,000 gallons of diesel fuel per year per mile). When compared to the baseline energy usage of I-90 traffic (Table 2-1), this represents a 16% increase in I-90's current energy usage per mile of transportation; however, it is a small impact on the regional fuel supply. Impacts on traffic, air, and noise quality are discussed in the Transportation and Air and Noise Technical Reports.

Alternative 2A–Upper Site Mining and Limited Lower Site Mining

The impacts are similar to Alternative 2.

3.2.3 Alternative 3–Lower and Upper Sites Mining - Exits 34 and Exit 38

A number of energy use activities in Alternative 3 are considered direct impacts on energy use in the study area, including additional truck traffic on I-90, mining excavation equipment, aggregate processing equipment, asphalt and batch plant equipment, process water handling equipment, and building energy use.

Electrical

The electrical energy-use impacts for this alternative would vary slightly from Alternative 2. Electrical power would be required at the Upper Site to power the aggregate processing operations. A conveyor is not included in this alternative. Aggregate processing would take place at the Upper Site at the completion of extraction from the Lower Site. The concrete and asphalt batch plants would remain in operation at the Lower Site. The maximum electrical load for this alternative is estimated to be about 95% of Alternative 2's energy consumption (3.6 MW), or about 3.4 MW.

Electrical service would need to be extended from the Lower Site to the Upper Site, or a separate line may be constructed, entering the site near the Washington State Patrol Fire Training Academy. An existing underground power line at the Upper Site would need to be removed or relocated prior to starting excavation in that area. Impacts of this relocation are discussed in the Public Utilities Technical Report.

Fuel

Fuel for Onsite Uses

The impacts are similar to those listed for Alternative 2.

Fuel Use for Transport

Since Alternative 3 does not include a conveyor system linking the Lower and Upper Sites, aggregate must be hauled between the Lower and Upper Sites by truck. Part of the aggregate would be routed to the batch plants at the Lower Site; other materials would be hauled off site to supply aggregate for Cadman, Inc.'s Issaquah and Renton plants. The planned route is along the existing alignment of a local access road leading to the Washington State Patrol Fire Training Academy, at the northeast corner of the Upper Site. Significant alterations to the existing SE Grouse Ridge Road would be required. The road is currently unsuitable, both in width and grade, to accommodate this truck traffic. Road conditions are discussed and analyzed in the Transportation Technical Report.

Alternative 3's energy use includes onsite transportation of aggregate to the Lower Site's batch plants and offsite traffic to transport aggregate and products to other facilities. Alternative 3 would increase the volume of truck traffic along the existing road linking the Lower and Upper Sites, as aggregate must be hauled approximately 8 miles from the Upper Site to the asphalt and concrete batch plants at the Lower Site. Based on estimates prepared by Heffron Transportation, 118 trucks per day would travel between the Lower and Upper Sites to provide aggregate to the batch plants. The onsite batch plants would, in turn, produce up to 156 loads of concrete and 60 loads of asphalt, which would be hauled to offsite customers.

An additional 568 gravel truck loads would leave the extraction site each day to supply aggregate to Cadman, Inc.'s Issaquah and Renton plants, while 152 truck loads are hauled directly to project sites as fill. These 720 gravel trucks would exit via the Upper Site, traveling along SE Grouse Ridge Road to Exit 38. This route is approximately 8 miles longer than the Exit 34 route used for Alternative 2.

Table 3-2, using the ODOT spreadsheet, shows the incremental increase in energy use (fuel), as compared to Alternative 2, to transport aggregate and product from the site to Exit 38. The increase in onsite energy use associated with Alternative 3 would be 315 million BTUs per day (2,266 gallons of diesel fuel), or 115 billion BTUs (827,000 gallons of diesel fuel) per year. On a per-mile basis, this is an incremental increase in energy use over Alternative 2 of 39.4 million BTUs (283 gallons of diesel fuel) per day per mile of roadway.

A total of 936 heavy trucks and 62 passenger vehicles would be added to I-90's base traffic flow as a result of this alternative. For comparison to the affected environment values (Table 2-1), these estimates have been expressed as energy consumption per mile of highway. This is identical to the estimated traffic impact

of Alternative 2, which results in energy consumption of 32.5 million BTUs (235 gallons of diesel fuel) per day per mile of highway, or 11.9 billion BTUs (86,000 gallons of diesel fuel) per year per mile of highway.

When the incremental increase in energy use per mile for onsite haul of aggregate/product (Table 3-2) and the energy use for transportation on I-90 (Table 3-1) are compared to the baseline energy usage (Table 2-1), this represents a 36% increase over I-90's current energy usage per mile of transportation. Although this is a high percentage of increase, the impact on the diesel fuel supply in the region would be small.

Alternative 3A–Upper Site Mining and Limited Lower Site Mining - Exits 34 and 38

The impacts are similar to those listed for Alternative 3.

3.2.4 Alternative 4–Upper Site Mining - Exit 38

This alternative would have less energy impact than Alternatives 2 and 3, as only the Upper Site would be developed and no batch plants would be constructed. The direct energy use impacts of Alternative 4 include mining excavation equipment, aggregate processing equipment, building energy use, and transportation of material to offsite concrete and asphalt batch plants.

Electrical

Since the Lower Site would not be developed under this alternative, the volume of aggregate excavated and processed as part of Alternative 4 would be approximately 5% less than Alternatives 2 and 3. There would be no conveyor line for this alternative, and process water would not be pumped up the ridge to the Upper Site. The concrete and asphalt batch plants are also not included in this alternative, further reducing the operational demand. The total maximum electrical load for peak operations is estimated to be about 65% of Alternative 3, or about 2.2 MW. Impacts on local energy usage would be low if mitigation is implemented.

There are two alternatives for bringing power to the Upper Site. PSE has an existing 34 kV, 3-phase supply to the site, and BPA has existing high voltage power lines that run through the Upper Site. Both of these sources require additional infrastructure to deliver power to the site.

Fuel

Extraction would occur at the Upper Site and material would be hauled directly from the site for delivery to project sites as fill or as raw materials for Cadman, Inc.'s facilities in Issaquah and Redmond. This would result in fewer truckloads hauled out via SE Grouse Ridge Road. Based on estimates prepared by Heffron Transportation, about 568 trucks per day would haul aggregate to offsite processing facilities, and 316 trucks per day would haul aggregate to project sites as fill. Additionally, fewer employees would be required for site operations. As with Alternative 3, significant alterations to SE Grouse Ridge Road would be required.

The haul distance from the Upper Site to the offsite processing facilities includes 8 miles along the SE Grouse Ridge Road from the Upper Site to I-90 and an average haul of 23 miles to either the Issaquah or Redmond facility. Based on estimates prepared by Heffron Transportation, approximately 568 gravel trucks would travel 31 miles per trip to the Issaquah and Redmond facilities each day. While requiring fewer

workers, daily operation would still add approximately 52 passenger vehicles per day traveling on SE Grouse Ridge Road. Table 3-3, based on ODOT's spreadsheet, shows the incremental increase in energy use (fuel), as compared to Alternative 2, to transport aggregate and employees from the site to Exit 38. The increase in onsite energy use associated with Alternative 4 would be 664 million BTUs (4,780 gallons of diesel fuel) per day, or 242 billion BTUs (1,750,000 gallons of diesel fuel) per year. On a per-mile basis, this is an incremental increase in energy use over Alternative 2 of 21.4 million BTUs per day per mile of transportation (155 gallons of diesel fuel per day per mile).

A total of 886 heavy trucks (95% of Alternative 2's estimate) and 52 passenger vehicles would be added to I-90's base traffic flow as a result of this alternative. For comparison with the affected environment values (Table 2-1), these estimates have been expressed as energy consumption per mile of transportation. Alternative 4's traffic (Table 3-4) represents an energy consumption of 30.7 million BTUs (220 gallons of diesel fuel) per day per mile of highway, or 11.2 billion BTUs (81,000 gallons of diesel fuel) per year per mile of highway.

When the incremental increase in energy use per mile for haul and transportation from the site (Table 3-3) and on I-90 (Table 3-4) are compared with the baseline energy usage (Table 2-1), this represents a 26% increase over I-90's current energy usage per mile of transportation. Although this is a high percentage of increase, the impact on the regional diesel fuel supply would be low.

Natural Gas/Propane Gas

There are no natural gas or propane gas uses proposed for this alternative.

3.3 CUMULATIVE IMPACTS

Secondary or cumulative energy impacts from the proposed development should be viewed in terms of local and regional growth in energy demand. As populations increase and new or existing industries and commercial energy users grow and expand, the regional sources and availability, quality, and cost of energy will change. Based on historic trends, energy use and demand will expand throughout the area. The proposed development represents a minor input into the overall energy demand and distribution patterns of the Pacific Northwest, reflecting annual consumption similar to the sales of small commercial fuel service stations in King County. Impacts to local energy suppliers are mitigable using conventional Industry practices. No specific secondary and cumulative impacts from the proposed development were identified during the energy analysis.

3.4 SUMMARY OF MITIGATION MEASURES

3.4.1 Alternative 1–No Action

No mitigation measures are required.

3.4.2 Alternatives 2, 2A, 3, 3A and 4

Electrical power use and sources appear adequate to serve the needs of the project. Supply and distribution systems would be designed to ensure that power quality remains unchanged for area consumers. The

following mitigation measures are recommended to minimize energy use and prevent potential impacts to local suppliers:

- Major electrically powered equipment should use power quality controls.
- Centralized power conditioning within the development area, or separate power feeds and power quality controls originating at the power substation should be used.
- The conveyor system should be designed to generate and harness power for site use.

For Alternatives 2, 2A, 3 and 3A, the following are recommended:

- The large motors associated with the asphalt batch plant process should use variable frequency drivemotors to prevent a large voltage drop when the motors are started.
- Transformers should be sized to handle the voltage drop as well as the working load, and should be located as close as possible to each service point.
- The wire gauge should be sized to maximize voltage to the motors.

The proximity of the proposed site to the existing PSE and future Tanner substations would minimize voltage fluctuations.

Energy use by heavy truck and passenger vehicle traffic associated with each alternative could be minimized through mitigation measures such as the following:

- Fuel-efficiency improvements for specific transport vehicles
- Road improvements for more efficient transportation
- Car pooling (passenger vehicles only)
- Optimization of transportation methods and routes

All applicable regulations regarding storage and use of propane gas must be followed for Alternatives 2 and 3.

3.5 SIGNIFICANT UNAVOIDABLE ADVERSE IMPACTS

3.5.1 Alternatives 1, 2, 3, and 4

No significant unavoidable adverse impacts were identified.

TABLE 2-1

Project Information:		Data Information		
	North Bend Gravel Operation	Trucks Btu/day	9.98E+07	
	King County	Autos Btu/day	9.93E+07	
	Alternative 1			
	May 12, 1999	Total Energy	7.27E+10	Btu/year
			7.67E+10	Kj/year

TABLE

TOTAL ADT's	Roadway SECT #	Roadway LENGTH	ADT Trucks	SPEED (mph)	FCR (GPM)	TRUCK (gal/day)	ADT AUTOS	SPEED (mph)	FCR (GPM)	AUTO (gal/day)
14634	1 - East	1	2927	55	0.123	360.00	11707	55	0.034	398.04
14566	1 - West	1	2913	55	0.123	358.32	11653	55	0.034	396.20

ADT = Average Daily Traffic
FCR = Fuel Consumption Rate

TABLE 3-1

ALTERNATIVE 2 - ADDITIONAL VEHICLES AND TRUCKS TRAVELING 1 MILE ON I-90 BY EXIT 34

Project Information:		Data Information		
	North Bend Gravel Operation	Trucks Btu/day	3.20E+07	
	King County	Autos Btu/day	5.27E+05	
	Alternative 2			
	May 11, 1999	Total Energy	1.19E+10	Btu/year
			1.25E+10	Kj/year

TABLE

TOTAL ADT's	Roadway SECT #	Roadway LENGTH	ADT Trucks	SPEED (mph)	FCR (GPM)	TRUCK (gal/day)	ADT AUTOS	SPEED (mph)	FCR (GPM)	AUTO (gal/day)
998	1 - East	1	936	55	0.123	115.13	62	55	0.034	2.11
998	1 - West	1	936	55	0.123	115.13	62	55	0.034	2.11

TABLE 3-2

ALTERNATIVE 3 - ADDITIONAL GRAVEL TRANSPORTATION DISTANCE FROM UPPER SITE TO I-90 AND GRAVEL TRANSPORTATION TO ASPHALT/CONCRETE PLANT ON THE LOWER SITE

Project Information:

North Bend Gravel Operation
King County
Alternative 3
May 11, 1999

Data Information

Trucks Btu/day	3.15E+08	
Autos Btu/day	0.00E+00	
Total Energy	1.15E+11	Btu/year
	1.21E+11	Kj/year

TABLE

TOTAL ADT's	Roadway SECT #	Roadway LENGTH	ADT Trucks	SPEED (mph)	FCR (GPM)	TRUCK (gal/day)	ADT AUTOS	SPEED (mph)	FCR (GPM)	AUTO (gal/day)
720	North	8	720	20	0.169	973.44	0	0	0.034	0.00
720	South	8	720	20	0.169	973.44	0	0	0.034	0.00
118	North	8	118	20	0.169	159.54	0	0	0.034	0.00
118	South	8	118	20	0.169	159.54	0	0	0.034	0.00

TABLE 3-3

ALTERNATIVE 4 - TRANSPORTATION TO OFFSITE ASPHALT/CONCRETE BATCH FACILITY

Project Information:

North Bend Gravel Operation
King County
Alternative 4
May 11, 1999

Data Information

Trucks Btu/day	6.60E+08
Autos Btu/day	3.54E+06
Total Energy	2.42E+11 Btu/year
	2.56E+11 Kj/year

TABLE

TOTAL ADT's	Roadway SECT #	Roadway LENGTH	ADT Trucks	SPEED (mph)	FCR (GPM)	TRUCK (gal/day)	ADT AUTOS	SPEED (mph)	FCR (GPM)	AUTO (gal/day)
568	2 - East	8	568	20	0.169	767.94	52	20	0.034	14.14
568	2 - West	8	568	20	0.169	767.94	52	20	0.034	14.14
568	1 - East	23	568	55	0.123	1606.87	0	0	0.034	0.00
568	1 - West	23	568	55	0.123	1606.87	0	0	0.034	0.00

TABLE 3-4

ALTERNATIVE 4 - VEHICLE TRANSPORTATION OFFSITE TO HIGHWAY

Project Information:

North Bend Gravel Operation
King County
Alternative 4
May 11, 1999

Data Information

Trucks Btu/day	3.03E+07
Autos Btu/day	4.42E+05
Total Energy	1.12E+10 Btu/year
	1.18E+10 Kj/year

TABLE

TOTAL ADT's	Roadway SECT #	Roadway LENGTH	ADT Trucks	SPEED (mph)	FCR (GPM)	TRUCK (gal/day)	ADT AUTOS	SPEED (mph)	FCR (GPM)	AUTO (gal/day)
938	East	1	886	55	0.123	108.98	52	55	0.034	1.77
938	West	1	886	55	0.123	108.98	52	55	0.034	1.77

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